

## CLAIMS

1) Catalytic composition comprising gallium,  
at least one element chosen in the group of the  
lanthanides and a zeolite belonging to the MFI, MEL  
5 or MFI/MEL families, the crystal lattice of which  
is made up of silicon oxide and at least one metal  
oxide chosen from among aluminium oxide, boron  
oxide and gallium oxide.

2) A composition according to Claim 1, in  
10 which the zeolite is chosen from among ZSM-5,  
zeolites having an MFI structure based on silicon  
oxide, gallium oxide and possibly aluminium oxide,  
zeolites having an MFI structure based on silicon  
oxide and boron oxide, ZSM-11, zeolites having a  
15 MEL structure based on silicon oxide and boron  
oxide, ZSM-8, and zeolites having an MFI/MEL  
structure based on silicon oxide and boron oxide.

3) A composition according to Claim 2, in  
which the zeolite is ZSM-5.

20 4) A catalytic composition according to Claim  
1, in which the molar ratio between silica and the  
metal oxide is greater than 20.

5) A catalytic composition according to Claim  
4, in which the molar ratio between silicon oxide  
25 and metal oxide is greater than 20 and less than

500.

6) A catalytic composition according to Claim 5, in which the molar ratio between silicon oxide and metal oxide is greater than 20 and less than or equal to 70.

7) A catalytic composition according to Claim 6, in which the molar ratio between silicon oxide and metal oxide is greater than 20 and less than 60.

8) A catalytic composition according to Claim 1, comprising gallium, at least one element chosen in the group of the lanthanides and a zeolite belonging to the MFI family characterized by crystallites which for at least 90% have diameters smaller than 500 Å.

9) A catalytic composition according to Claim 8, in which the MFI zeolite consists of crystallites with diameters smaller than 500 Å.

10) A catalytic composition according to Claim 8, in which the crystallites of the MFI zeolite present in the form of mulberry-shaped submicron aggregates with an extrazeolitic porosity of a meso-macroporous nature.

11) A catalytic composition according to Claim 10, in which the total volume of said extrazeolitic

porosity consists for at least 30% of pores with diameters of less than 500 Å.

12) A catalytic composition according to Claim 8, in which the crystal lattice of the MFI zeolite is made up of silicon oxide and aluminium oxide.

13) A catalytic composition according to Claim 12, in which the molar ratio between silicon oxide and aluminium oxide is greater than 20.

14) A catalytic composition according to Claim 13, in which the molar ratio between silicon oxide and aluminium oxide is greater than 20 and less than 500.

15) A catalytic composition according to Claim 14, in which the molar ratio between silicon oxide and aluminium oxide is greater than 20 and less than or equal to 100.

16) A catalytic composition according to Claim 1 or Claim 8, in which the zeolite is partially in acid form.

17) A catalytic composition according to any one of the foregoing claims, containing, in addition, rhenium.

18) A catalytic composition according to Claim 1, Claim 8 or Claim 17, in which the lanthanide is present in the form of an oxide, ion, metal, or is

a mixture of these forms.

19) A catalytic composition according to Claim 1, Claim 8 or Claim 17, in which the amount of lanthanide, expressed as element, ranges from 0.01 to 10 wt%.

20) A catalytic composition according to Claim 19, in which the amount of lanthanide, expressed as element, ranges from 0.1 to 2 wt%.

21) A catalytic composition according to Claim 1, Claim 8 or Claim 17, in which the lanthanide is chosen from among neodymium and lanthanum, either alone or in mixtures with cerium and/or praseodymium, and mixtures of neodymium and lanthanum, possibly also containing cerium and/or praseodymium.

22) A catalytic composition according to Claim 1, Claim 8 or Claim 17, in which the gallium is present in the form of an oxide, gallium ion, metallic gallium, or is a mixture of said forms.

23) A catalytic composition according to Claim 1, Claim 8 or Claim 17, in which the amount of gallium, expressed as element, ranges from 0.05 to 10 wt%.

24) A catalytic composition according to Claim 23, in which the amount of gallium, expressed as

element, ranges from 0.5 to 4 wt%.

25) A catalytic composition according to Claim 17, in which the amount of rhenium, expressed as element, ranges from 0.05 to 10 wt% with respect to the total weight of the catalytic composition.

26) A catalytic composition according to Claim 25, in which the amount of rhenium ranges from 0.5 to 4 wt%.

27) A catalytic composition according to Claim 17, in which the rhenium is present in the form of an oxide, ion, metal, or is a mixture of said forms.

28) A catalytic composition according to Claim 1, Claim 8 or Claim 17, containing a binder chosen from among silica, alumina and clay, in a proportion by weight ranging from 50:50 to 95:5.

29) A catalytic composition according to Claim 8 or Claim 12, in which the zeolite is prepared by subjecting to vigorous stirring a solution containing sources of tetra-propyl-ammonium ion, sodium oxide, aluminium oxide, silicon oxide, and water, having the following composition expressed as molar ratios:

$\text{OH}^-_{\text{free}}/\text{SiO}_2$  0.07-1.0

$(\text{C}_3\text{H}_7)_4\text{N}^+/\text{SiO}_2$  0.01-1

$\text{H}_2\text{O}/\text{OH}^-_{\text{free}}$  10-300

$\text{SiO}_2/\text{Al}_2\text{O}_3$  > 5

$\text{Na}^+/\text{SiO}_2$  0.6-5

up to completion of crystallization.

- 5        30) A catalytic composition according to Claim 29, in which the composition of the synthesis mixture is the following:

$\text{OH}^-_{\text{free}}/\text{SiO}_2$  0.1-0.3

$(\text{C}_3\text{H}_7)_4\text{N}^+/\text{SiO}_2$  0.05-0.25

10        $\text{H}_2\text{O}/\text{OH}^-_{\text{free}}$  20-60

$\text{SiO}_2/\text{Al}_2\text{O}_3$  50-120

$\text{Na}^+/\text{SiO}_2$  1-4

- 31) Composition according to Claim 29, in which the crystallization is performed at a  
15 temperature in the range from 90 to 130°C, under stirring for a time which ranges from 3 hours to 15 days, and possibly comprises a second stage that can last up to 5 days in which the temperature is raised to a value ranging from 110 to 160°C.

- 20       32) Composition according to Claim 29, in which the source of the tetra-propyl-ammonium ion is chosen from among the corresponding bromide or hydroxide or tri-*n*-propylamine in mixture with *n*-propyl bromide.

- 25       33) Composition according to Claim 29, in

which the source of silicon oxide is chosen from among sodium silicate, silica hydrosol, silica gel, and silicic acid.

34) Composition according to Claim 29, in  
5 which the source of aluminium oxide is chosen from among sodium aluminate, alumina, aluminium sulphate, and aluminium nitrate.

35) Composition according to Claim 29, in  
10 which the source of sodium is chosen from among the corresponding hydroxide, halides, sulphate and/or from among the sources of aluminium and/or silicon which contain it.

36) A process for preparing the catalytic compositions according to Claim 1 or Claim 8, which  
15 comprises treating the zeolite with a gallium compound, treating the product thus obtained with a lanthanide compound, drying and calcining.

37) A process for preparing the catalytic composition according to Claim 1 or Claim 8, which  
20 comprises treating the zeolite with a lanthanide compound, treating the product thus obtained with a gallium compound, drying and calcining, or else treating the zeolite with a mixture comprising a gallium compound and a lanthanide compound, drying  
25 and calcining.

38) A process according to Claim 36 or Claim 37, in which the zeolite is in acid form.

39) A process according to Claim 36, Claim 37 or Claim 38, in which the treatment with a gallium compound and the treatment with a lanthanide compound are chosen from between ion exchange and impregnation.

40) A process according to Claim 39, in which ion exchange and impregnation are performed using an aqueous solution of a gallium salt and an aqueous solution of a lanthanide salt.

41) A process according to Claim 39 or Claim 40, in which the treatment with a gallium compound consists in an ion exchange or impregnation with an aqueous solution of a gallium salt, and the treatment with a lanthanide compound consists in an impregnation with an aqueous solution of a lanthanide salt.

42) A process according to Claim 40, in which the gallium salt and the lanthanide salt are chosen from among the corresponding nitrates, chlorides and sulphates.

43) A process according to Claim 36 or Claim 41, which comprises the treatment of the zeolite by means of ion exchange or impregnation with an



aqueous solution of a gallium salt, drying,  
possibly calcining the resulting product, treating  
it by means of impregnation with an aqueous  
solution of a lanthanide salt, drying and  
5 calcining.

44) A process for preparing the catalytic  
composition according to Claim 17, which comprises  
treating the zeolite with a gallium compound, a  
lanthanide compound and a rhenium compound, in any  
10 order, drying and calcining.

45) A process according to Claim 44, which  
comprises: a) the treatment of the zeolite by means  
of ion exchange or impregnation with an aqueous  
solution of a gallium salt, drying, and possibly  
15 calcining the resulting product; b) treating it by  
means of impregnation with an aqueous solution of a  
lanthanide salt, drying and possibly calcining the  
resulting product; and c) treating it by means of  
impregnation with an aqueous solution of a rhenium  
20 salt, drying and calcining.

46) A process for the production of aromatic  
hydrocarbon compounds which comprises setting in  
contact one or more aliphatic hydrocarbons  
containing from 3 to 6 carbon atoms with a  
25 catalytic composition comprising gallium, at least

one element chosen in the group of the lanthanides,  
a zeolite belonging to the MFI, MEL or MFI/MEL  
families, the crystal lattice of which is made up  
of silicon oxide and at least one metal oxide  
5 chosen from among aluminium oxide, boron oxide and  
gallium oxide.

47) A process according to Claim 46, in which  
the zeolite is ZSM-5.

48) A process according to Claim 46, in which  
10 the molar ratio between silicon oxide and metal  
oxide is greater than 20.

49) A process according to Claim 48, in which  
the molar ratio between silicon oxide and metal  
oxide is greater than 20 and less than 500.

15 50) A process according to Claim 49, in which  
the ratio between silicon oxide and metal oxide is  
greater than 20 and less than or equal to 70.

51) A process according to Claim 50, in which  
the ratio between silicon oxide and metal oxide is  
20 greater than 20 and less than 60.

52) A process according to Claim 46, in which  
the catalytic composition comprises gallium, at  
least one element chosen in the group of the  
lanthanides and a zeolite belonging to the MFI  
25 family characterized by crystallites which for at

least 90% have diameters smaller than 500 Å.

53) A process according to Claim 52, in which the MFI zeolite consists of crystallites with diameters smaller than 500 Å.

5 54) A process according to Claim 52, in which the crystallites of MFI zeolite present in the form of mulberry-shaped submicron aggregates with an extrazeolitic porosity of a meso-macroporous nature.

10 55) A process according to Claim 54, in which the total volume of said extrazeolitic porosity consists for at least 30% of pores with diameters of less than 500 Å.

15 56) A process according to Claim 52, in which the crystal lattice of the MFI zeolite is made up of silicon oxide and aluminium oxide.

57) A process according to Claim 56, in which the molar ratio between silicon oxide and aluminium oxide is greater than 20.

20 58) A process according to Claim 57, in which the molar ratio between silicon oxide and aluminium oxide is greater than 20 and less than 500.

59) A process according to Claim 58, in which the molar ratio between silicon oxide and aluminium  
25 oxide is greater than 20 and less than or equal to

100.

60) A process according to Claim 46 or Claim 52, in which the zeolite is partially in acid form.

61) A process according to Claim 46 or Claim 52, in which the catalytic composition in addition contains rhenium.

62) A process according to Claim 46, Claim 52 or Claim 61, in which the lanthanide is chosen from among neodymium and lanthanum, either alone or in mixture with cerium and/or praseodymium, and mixtures of neodymium and lanthanum, possibly containing cerium and/or praseodymium.

63) A process according to Claim 46, Claim 52 or Claim 61, in which the hydrocarbon or the aliphatic hydrocarbons are chosen from among olefins, cyclo-olefins, paraffins, and cycloparaffins.

64) A process according to Claim 46, Claim 52 or Claim 61, in which the hydrocarbon or the aliphatic hydrocarbons contain from 4 to 5 carbon atoms.

65) A process according to Claim 63 or Claim 64, in which the aliphatic hydrocarbon is chosen from among *n*-pentane, *n*-pentenes, *n*-butane, *n*-butenes, iso-butane, iso-butene, methylbutenes,

cyclopentenenes, isopentane, cyclopentane, or their mixtures.

66) A process according to Claim 46, Claim 52 or Claim 61, in which mixtures of aliphatic hydrocarbons are used containing from 20 to 90 wt% of olefins.

67) A process according to Claim 66, in which mixtures of aliphatic hydrocarbons are used containing from 40 to 70 wt% of olefins.

68) A process according to Claim 46, Claim 52 or Claim 61, conducted at a temperature ranging from 300° to 800° C, and at a pressure ranging from 0 to 20 barg.

69) A process according to Claim 68, conducted at a temperature ranging from 400° to 650° C, and at a pressure ranging from 1 to 10 barg.

70) A process according to Claim 68, conducted at a WHSV ranging from 0.1 to 30 hours<sup>-1</sup>.